Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Unlicensed Use of the 6 GHz Band	)	ET Docket No. 18-295
	)	
Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz	)	GN Docket No. 17-183
	)	

COMMENTS OF NOKIA

Nokia respectfully submits these Comments in response to the Notice of Proposed Rulemaking ("NPRM") issued in the above-captioned proceeding.[1]

I. INTRODUCION AND SUMMARY

Nokia offers unparalleled leadership in the technologies that connect people and things. Nokia is leveraging its strengths to create a new type of network that is intelligent, efficient, and secure, and which will serve as a critical enabler of many capabilities and use cases associated with the Internet of Things (IoT). Nokia brings together, in one company, mobile broadband with fixed line access, and the underlying IP routing and optical technology that connects them. Critical to its perspective regarding the spectrum bands considered in this proceeding, Nokia is a leading vendor in fixed microwave equipment, including being a major vendor to the largest fixed service licensees in the 6 GHz band.

In these Comments, Nokia reviews the record and voices its agreement that incumbent fixed services (FS) in the 6 GHz band are robust, growing and must be protected. Rigorous engineering analysis and testing demonstrating that new services will not interfere with

[1] *Unlicensed Use of the 6 GHz Band,* Notice of Proposed Rulemaking, GN docket No. 18-295, *et al.*, FCC 18-147 (rel. Oct. 24, 2018) (*"NPRM").*

FS must be a prerequisite to such services being authorized – not mere platitudes regarding legal obligations of unlicensed devices to not interfere.

Nokia also respectfully submits a technical study into the record. As discussed below and in the Technical Appendix submitted with these Comments, the technical study demonstrates that FS operations can be disrupted not only from proposed outdoor unlicensed operations but also from indoor unlicensed operations. Based on the findings of our study, Nokia recommends that unlicensed access – both indoor and outdoor – be governed by an Automatic Frequency Coordination System (AFC) for the sub-bands most heavily used by fixed links, i.e., 5.925-6.425 GHz (U-NII-5) and 6.525-6.875 GHz (U-NII-7). For the 6.425-6.525 GHz (U-NII-6) and 6.875-7.125 GHz (U-NII-8) sub-bands which have no, or a very limited number of fixed links but have mobile services, restricting the U-NII devices to indoor low power use without an AFC system is acceptable. However, Nokia recommends studying if high power operation in U-NII-6 and U-NII-8 is also feasible via an AFC system.

II. ANY NEW SERVICES OPERATING IN THE 6 GHZ BAND MUST PROTECT CRITICAL INCUMBENT USES FROM HARMFUL INTERFERENCE

In the Notice of Inquiry phase of this proceeding,[2] Nokia raised concerns whether any new services, including unlicensed operations, could be introduced into the lower or upper portions of the 6 GHz bands without causing harmful interference into incumbent terrestrial fixed services. Other parties voicing their concerns in this proceeding include public safety officials, public utilities, and telecommunications services providers.[3] Nokia also urged in its

[2] *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz,* Notice of Inquiry, GN docket No. 17-183, FCC 17-104 (rel. Aug. 3, 2017) (*"NOI").*

[3] *See, e.g.,* Comments of APCO International, GN Docket No. 17-183, filed Oct. 2, 2017, at iii ("Permitting flexible use of the 6 GHz bands for wireless broadband could be detrimental to public safety communications."); Comments of the Utilities Technology Council and the Edison Electric Institute, GN Docket No. 17-183, filed Oct. 2, 2017, at 6-12 (. . . any marginal benefit that might be gained by expanded use of the 6 GHz bands would be outweighed by the potential for interference to utility mission critical communications.); Comments of AT&T Services, Inc., GN

Comments that mere reliance on legal requirements to not cause interference into incumbent services, set forth in Part 15 of the Commission's rules, would not be sufficient to protect these vital services. Rigorous engineering analysis and testing to demonstrate a lack of harmful interference should be required before introducing a new unlicensed service into the band.

Nokia is pleased that the NPRM reflects these concerns and insists on protection of incumbent services. Specifically, the Commission recognizes that:

> The fixed service is used for highly reliable point-to-point microwave links that support a variety of critical services such as public safety (including backhaul for police and fire vehicle dispatch), coordination of railroad train movements, control of natural gas and oil pipelines, management of electric grids, long-distance telephone service, and backhaul for commercial wireless providers such as traffic between commercial wireless base stations and wireline networks.[4]

Further, the Commission's stated goal is to expand unlicensed use in the band, "designed to protect important incumbent licensed services that operate (and continue to grow)" in the 6 GHz band.[5]

Through the NPRM, the Commission strives to find the optimal answer on how to do this based on technical evidence. Again: mere legal promises not to interfere – which can be enforced only after the damage is done – are not sufficient. Through these Comments, Nokia provides engineering analysis to inform the record and ensure that the Commission achieves its dual goal of inducing new services while not harming the critical fixed services that have been operating, evolving and growing in the 6 GHz band.

Docket No. 17-183, filed Oct. 2, 2017, at 12-17 (". . . attempting to shoehorn unlicensed use into the 6 GHz band poses grave dangers.").

[4] NPRM at ¶ 9.

[5] NPRM at ¶ 20.

III. NOKIA'S TECHNICAL STUDY SUPPORTS THE USE OF AN AUTOMATED FREQUENCY COORDINATION SYSTEM IN THE 6 GHZ BAND TO PROTECT INCUMBENT FIXED LINKS

Nokia has studied the coexistence between U-NII Devices and Fixed Service (FS) Links for the 6 GHz band. We use the term "U-NII devices" for 6 GHz unlicensed devices generally. Attached to these Comments, Nokia submits a Technical Appendix with detailed results of our study. For our study, we assumed the transmit power assumed for the U-NII devices are as set in the NPRM for indoor and outdoor cases.[6] Interference caused by the new U-NII networks to FS receivers is simulated using a dynamic system simulator, which models the U-NII radio access technology at a detailed level with realistic traffic loads, medium access protocols, transmit output power levels, and transceiver impairments. The attached Technical Appendix details the assumed deployment models, propagation models and device antenna patterns.

Both co-channel and adjacent channel interference scenarios are considered, and the study focuses on three different deployment scenarios that include outdoor to outdoor and indoor to outdoor interference cases.

Under the assumptions and deployment scenarios considered, the study's results demonstrate that co-channel interference can be an issue not only in the case of outdoor U-NII devices, but also for indoor operation of U-NII devices.

- For the sub-bands most heavily used by fixed links, i.e., 5.925-6.425 GHz (U-NII-5) and 6.525-6.875 GHz (U-NII-7), the Commission should allow indoor and outdoor access point operations only under the control of an AFC system to mitigate potential interference from the U-NII devices to the fixed links.
- For the 6.425-6.525 GHz (U-NII-6) and 6.875-7.125 GHz (U-NII-8) sub-bands which

[6] NPRM at ¶ 78.

have no, or a very limited number of fixed links but have mobile services such as the Broadcast Auxiliary Service and Cable Television Relay Service, restricting the U-NII devices to indoor low power use without an AFC system is acceptable. However, Nokia recommends studying if high power operation in U-NII-6 and U-NII-8 is also feasible via an AFC system without interfering with these mobile systems.

Based on our findings, Nokia recommends that the Commission consider the use of an AFC system for both outdoor and indoor U-NII devices in 5.925-6.425 GHz (U-NII-5) and 6.525-6.875 GHz (U-NII-7) to protect the fixed links in these two sub-bands. Further study would be needed before the Commission allows an AFC system to enable outdoor high-power U-NII devices in 6.425-6.525 GHz (U-NII-6) and 6.875-7.125 GHz (U-NII-8). If an AFC system is not viable because of the itinerant nature of the incumbent mobile systems in U-NII-6 and U-NII-8, the U-NII devices should be restricted in these two sub-bands to indoor low power operation without an AFC system. Furthermore, it is absolutely essential to the efficacy of an AFC that FS licensees be given the opportunity to ensure their operations are accurately reflected it the Commission's systems so that the AFC has the information necessary to protect them.

With respect to any tentative technical conclusions reached by the Commission, since the key component of the coexistence framework is the AFC system, we recommend that the Commission and/or a group of stakeholders define the requirements of the AFC system in detail and that the AFC system is tested before it is commercially deployed.

IV. CONCLUSION

Nokia appreciates the Commission's consideration and respectfully requests that the Commission adopt rules for the 6 GHz band that protect existing and future FS systems from harmful interference, and that the technical rules in the band are guided by the findings in Nokia's Technical Study included with these Comments.

Respectfully submitted,

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